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ABSTRACT

Skill acquisition is conceptualized as a three-step process in which students sequentially know about, understand, and apply a skill. Skills are described as conceptually based actions whose performance in the classroom is dependent upon cognitive factors. Written classroom simulations are described as one effective means of measuring comprehension of a skill. The function of these simulations is to ascertain understanding of these skills before students are asked to demonstrate these skills in micro-teaching or classroom settings. (Authors)

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THE USE OF WRITTEN SIMULATIONS IN THE MEASUREMENT OF TEACHING COMPETENCIES

INTRODUCTION

The goal of any teacher education program is the development of competent teachers. One way of defining such people is in terms of the skills a teacher exhibits in the classroom. The purpose of this paper is to present a model of skill learning, and to describe one means of measuring skill acquisition within that model.

A MODEL OF SKILL LEARNING

Learning to perform a skill can be described as a hierarchical series of steps beginning with knowledge of the skill, comprehending its use in the classroom and culminating in its application in classroom settings (Bloom, et. al., 1956). At the first level students can provide a definition of a skill or can recognize a correct definition when they encounter one. However, being able to cite a definition does not ensure that the student understands the skill or could recognize it in a classroom demonstration (Anderson, 1972). At the comprehension level students are able to discriminate between instances and non-instances of the skill being performed in the classroom. This level is a critical interim step in the mastery of skills, for without comprehension of the skill there is little chance that it can be applied in a systematic way in the classroom. At the application level the student is able to perform the skill in real life or simulated settings. The hierarchy can be summarized as follows:

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Level	Learner Behavior
Application	The Learner can utilize the skill in either real life or simulated settings.
Comprehension	The Learner can can recognize a skill being correctly applied.
Knowledge	The Learner can produce or recognize the correct definition of a skill.

Figure 1.
A Conceptual Model of Skill Learning

This hierarchy is based upon a conceptual view of skill learning. This approach views skills as actions that are based upon concepts, which are classes or categories that are defined by essential characteristics (Klausmeier, 1974). Square, mammal and verb are all concepts; class inclusion in these categories is defined by several key characteristics, e.g., closed geometric figure, four-sides equal sides and equal interior angles.

Some representative skill-related concepts in teacher education are prompt, probe, redirect, and inductive and deductive lessons. Each of these skills can be thought of as a category of behavior. Performance of the skill is dependent upon an understanding of the concept. For example, the questioning skill of prompting is based upon the teacher's understanding of the concept prompt. To use this skill the teacher must first understand the concept. In a similar manner, before a teacher can teach an inductive lesson, he or she must first understand the concept, inductive lesson.

There are several implications of this hierarchical model of skill learning. First, the model suggests an optimal series of steps in teaching these skills; the learner must first know and understand a skill before he can apply it. Related to this is the idea that failure to perform at one level may be

due to lack of achievement at a lower level, i.e., a student's lack of comprehension may be the reason he can't apply a skill. Consequently, adequate instruments to measure students' comprehension of different skills become a crucial component of skill-based teacher education programs.

THE MEASUREMENT OF NON-INTERACTIVE TEACHING SKILLS

For the purposes of this paper teaching skills will be divided into two major categories: interactive and non-interactive. Interactive teaching skills are characterized by an interchange between teacher and students. These are contrasted with non-interactive skills (for lack of a better name) which do not typically include an exchange between teacher and pupils, e.g., formulating objectives, writing lesson plans, and constructing test items.

The previously discussed hierarchy can be readily applied to the evaluation of non-interactive teaching skills. For example, the skill of writing objectives can be measured at the knowledge, comprehension or application level as is shown in Figure 2.

Level	Learner Behavior
Application	The learner can write objectives in his own discipline.
Comprehension	The learner is able to differentiate between correctly and incorrectly written objectives.
Knowledge	The learner knows the essential components of an objective.

Figure 2.
A Hierarchical Model of Learning
Applied to the Skill of Writing Objectives

Similar types of hierarchies could be constructed for other non-interactive skills such as preparing a lesson plan or the writing of measurement items.

THE MEASUREMENT OF INTERACTIVE TEACHING SKILLS

While written scenarios are useful in measuring non-interactive skills, they probably are most valuable in assessing students' comprehension of interactive teaching skills. The measurement of competence in interactive skills is often difficult because performance of the skill depends on cues from the environment. Measuring a student's ability to prompt requires placing the individual in situations where a prompt is appropriate and observing whether he can perform that skill. Similarly, measuring a student's comprehension of the skill-related concept of prompt requires that the individual can identify the concept in context. This can be done by providing the learner with videotapetape protocols of teaching situations and asking the individual to identify examples of the concept. Use of such materials is often difficult because of their cost, and the problem of finding materials that fit the objectives of a particular teacher education program. An alternative is the use of written simulations, which can be constructed with a minimum cost and effort and which can be tailor-made to fit a program's unique needs. The following are two written simulations which are designed to measure comprehension of the skill of prompting.

Example 1.

Read the following dialogue and enclose in parentheses all the teacher statements that are prompts.

Mr. Jones was involved in a lesson on mammals. He began by saying:
"Who can remember what we were discussing yesterday in science class? Billy?"
"We were talking about mammals," Jimmy responded.
"And, who can remember what we said about mammals? Anyone? Sarah?"
"They had fur and their blood was..."
"What about their blood, Sarah? How does a mammal feel when you touch him?"
"Oh, I know. Dogs are mammals and they're warm when you touch them. Mammals are warm-blooded."
"Excellent, Sarah. And, class what else did we say about the circulatory system of animals?"
Silence.
"Well, what does a circulatory system do?"

In responding to this item the student would need to understand the concept prompt and discriminate between examples and non-examples of it. An item such as this measures students' ability to recognize situations where particular skills are being used by others. However, the ultimate goal of a teacher education program is to develop the ability to recognize such situations and actually apply the skills. Closer to this goal is the following type of item.

> Read the following description of a classroom and identify situations where a prompt should have been used. Where appropriate construct a prompt that might be used.
>
> "As we were discussing verbs yesterday, we mentioned that there were two main types of verbs. Does anyone remember what they were? Jim?"
>
> _____
>
> "Active and ..."
> "Active and passive. Good Jim. And who can remember the difference between the two? Anyone? Mary?"
>
> _____
>
> "Active verbs can take objects and passive verbs can't."
> "Excellent. Now who can give me some examples of active verbs? Joe?"
>
> _____
>
> "Mary."
>
> _____
>
> "Hit, catch and cook."
> "Fine..."
>
> _____

This type of item is more difficult than the previous one, in that students not only had to identify situations in which the skill was appropriate but also had to apply the skill. Admittedly, applying the skills in a classroom with thirty students would be a more difficult task than doing so on a test item like this. However, we would suggest that inability to perform on a written item such as this would reliably predict inability to perform the skill in an actual classroom setting. Diagnosing learning problems at this stage of the instructional sequence allows the instructor to remediate the problem before the student is faced with the multitude of diverse demands found in the typical

micro-teaching session or actual classroom.

Let's look now at another example. There is considerable emphasis in education on the teaching of process skills. However, before a teacher can help students develop process skills, she must comprehend them herself. The following exercise is designed to measure teachers' comprehension of the process skills being taught in an elementary science class.

Example 3.

Directions: In the blank in front of each numbered statement put O if the statement is an observation, I if the statement is an inference, P if it is a prediction, and G if it is a generalization. If the statement is none of these, leave it blank.

Miss Jones wanted her students to know that temperature affects the respiration rate of cold blooded animals.

She brought out two fish bowls with gold fish as shown in the diagram.

Each bowl had a gallon of water in it and a little imitation reef through which the fish could swim. The fish were hatched from the same group of eggs.

The children looked at the bowls excitedly and began making comments.

____ (1) "There's no striped fish in the bowl on the left," Mike said.
____ (2) "There's three striped fish in the bowl on the right," Ella added.
____ (3) "The fish in the left bowl are tired," John suggested.
____ (4) Miss Jones then queried, "Why do you say that, John?"
____ (5) "Those fish aren't moving as fast as the ones in the right bowl," John responded.
____ (6) Martha went on, "Did you put the fish in the right bowl before you put those in the left bowl?"
____ (7) "They were put in the bowls at the same time," Miss Jones explained.
____ (8) "There are more fish in the right bowl than in the left bowl, Beverly noted.
____ (9) "I know," Rosemary waved her hand excitedly, "if the number of fish were the same in both bowls, they would move around in the bowls the same."
____(10) "Go ahead and check that, Rosemary," Miss Jones urged. (Rosemary stuck a small net into the right bowl and took out one of the solid colored fish, which she dropped in the left bowl. The class watched the fish for a few moments.)

____(11) "The fish are sleepy," Betty added.
____(12) "They are still moving slowly," Peggy noted.
____(13) "The striped fish are stiring up the other fish," Eleanor suggested.
____(14) "I'll bet the fish would move faster if we put the striped fish in the left bowl," Gloria proposed.
____(15) "The left bowl has a film on the outside," Marcia commented.
____(16) "I'll bet the bowl is cold," Dorothy noted.
(Dorothy checked the bowls with her fingers.)
____(17) "The water in the left bowl is cooler," Dorothy stated.
____(18) "If we put ice cubes in the right bowl, the fish would slow down," Mary suggested.
____(19) "That's a very good idea, Mary," Miss Jones praised.
____(20) "I'll get some ice," Marva suggested, and she jumped up and went to the refrigerator.
____(21) The ice was put in the right bowl and the class waited a few moments.
____(22) "The fish in the right bowl are moving slowly now, too," Vivian exclaimed.
____(23) "Fish move according to the temperature of the water they're in," Sue suggested.
____(24) "Let's think about all this," Miss Jones prompted.
____(25) "Well, cold blooded animals are strongly affected by temperature," Allan noted.
____(26) "Fish are cold blooded animals, so they would be affected by the temperature," Jerry added.
____(27) "Now let's look at another animal," Miss Jones suggested. She then showed a filmstrip with a caribou romping in the snow, an elk trotting through a summer forest, a red deer galloping in a winter day, and a moose gamboling in a spring meadow.
____(28) Barry conjectured, "Animals in the deer family aren't affected very much by changes in temperature."
____(29) Leslie quickly noted, "We could separate animals into warm blooded and cold blooded."
____(30) "And warm blooded animals are less affected by temperature than cold blooded animals," Harriette added.
____(31) Ruth suggested, "There are cold blooded land animals as well as fish."
____(32) "There also are warm blooded animals in the water such as whales in addition to warm blooded animals such as deer," Miss Jones added.
____(33) "If warm blooded animals are less affected by temperature, and a snake is cold blooded, he should become sluggish in cold weather, too," Muriel suggested.
____(34) "That's all very good children," Miss Jones praised.

Another example measuring students' comprehension of process skills can be found in Appendix 1.

Another teaching skill taught in teacher preparation programs is the ability to structure lessons inductively or deductively. A prerequisite to this skill is the ability to recognize inductive and deductive sequences structured

by others. The following scenario is one way to measure students' comprehension of inductive and deductive instructional sequences.

Example 4.

Miss Bird wanted to teach her students that "children who take care of their teeth get fewer cavities than those who don.t"

She prepared two posters with pictures of children brushing teeth, types of toothpaste, dentists, children with smiles, children with frowns, and drawings of x-rayed teeth. The pictures were as follows:

POSTER I

Boy brushing teeth
Tube of Aim (f)
Smiling child showing white teeth
Boy saying to father, "See Dad, one cavity."
Drawing of x-ray with no cavities
Smiling dentist
Dish of carrots
Slice of brown bread
Girl saying, "No cavities in my checkup today, Mom."
Tube of Crest (F)

POSTER 2

Tube of Close-Up
Tube of Ultra-Bright
Frowning child showing a cavity
Boy grimacing to father saying, "I had six cavities."
Baby Ruth bar
X-ray showing several cavities
Concerned dentist
Bottle of Coke

Miss Bird then asked the students to look at the two posters. The students did and began making comments.

(1) Diana said, "The child in the first poster is happy."
(2) "The man in the white coat is ahppy too," Carol added.
(3) "There is toothpaste in each of the posters," Mary noted.
(4) "The ones in the first poster have big F's by them," Karen put in with a puzzled look.
(5) "I know what that means," Ed shouted excitedly.
(6) "Go ahead, Ed," Miss Bird smiled.
(7) "That means they have fluoride in them," Ed said proudly. "They said on TV one night in an advertisement that F stands for fluoride."
(8) "That's fine, Ed," Miss Bird said with a grin. "Go ahead, Gene," she went on.
(9) "The child is upset in the last poster," Gene said pointing at the posters.
(10) "He has cavities in his teeth," Janis noted.
(11) "Children sometimes eat bad food," Joe said.
(12) "Yes, see the candy bar," Phyllis added.

(13) "If the boy in the second poster would brush his teeth, he wouldn't get cavities as easy," Carol stated definitely.
(14) "Kids don't take care of their teeth," John put in.
(15) Miss Bird then asked, "Could you now make a statement that would incorporate all that you have determined?"
(16) John tentatively raised his hand. "Children don't get as many cavities if they take care of their teeth than if they don't take care of them."
(17) "That's very good, John," Miss Bird smiled.
(18) "I shouldn't have any cavities when I go to the dentist next time," Beverly grinned. "My mother makes me take care of my teeth!"

Answer the questions below with information from the anecdote.

1. An example in the anecdote where inductive reasoning was being done was:
   (a) Statements one and two where they said the child and the man in the white coat were happy,
   (b) Where John summarized their information and made the statement that children don't get as many cavities if they take care of their teeth than if they don't take care of them,
   (c) Statement 18 where Beverly incorporated previous information to make the statement that she shouldn't have any cavities when she goes to the dentist the next time,
   (d) Statement 11 where the children were said to eat bad food,
   (e) None of the previous statements show inductive reasoning.

Others examples of items designed to measure comprehension of this skill can be found in Appendix 2.

Identify in the scenario one place where deductive reasoning was used. Put this information in a deductive syllogism.

2. (a) Generalization_____
   _____
   (b) Condition_____
   _____
   (c) Conclusion_____
   _____

3. Look again at Miss Bird's activity and consider the <u>overall</u> <u>trend</u> in the activity. Choose the best response.
   (a) The activity was inductive because the students went from specific observations and inferences to generalizations at the end of the activity,
   (b) The activity was deductive because deductive reasoning was used at least two places in the activity,
   (c) The activity was inductive because the teacher didn't tell the students anything in the lesson,
   (d) The lesson was deductive because there was considerable teacher direction in the activity.

Let's now take a look at a final example involving the ability to discriminate between measurements and evaluations. (Measurements are defined as value-free observations, whereas evaluations are defined as value-laden decisions based upon measurements.)

Example 5.

In the blank beside each numbered statement write M if the statement is a measurement, and E if the statement is an evaluation. If it is neither, do not mark in the blank.

Ms. Bolden had written in her plan book regarding Tuesday's English class, "for students to understand prepositional phrases so that they can identify prepositional phrases in a list of sentences."

____(1) She then said to herself, "I'll give them a list of common prepositions and then show them some sentences with prepositional phrases in them."
____(2) As Ms. Bolden was going through the sentences, Ms. Bolden saw Steven poke Jimmy and whisper to him.
____(3) Ms. Bolden thought, "I've never seen Steve act that way before."
____(4) She further noted, "Mr. K. told me Jimmy is kind of a promoter."

____(5) "I'd better separate those two before they disrupt the class," she thought.
____(6) She determined there was a total of six phrases in the two sentences.
____(7) She said to herself, "The children could understand the phrases in the sentences except those in which above and under were the prepositions.

Again, the ultimate goal of this instructional sequence is to produce teachers who can consciously make measurements and evaluations and realize the difference between the two. It is the position of the writers (and this position has been verified by informal measurements) that a prerequisite to applying this skill in the classroom is the ability to identify examples in context.

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APPENDIX 1

The following scenario measures elementary science students' ability to identify observations (O), generalizing inferences (GI), predictive inferences (PI), and explanatory inferences (EI).

Mister Jones class was discussing some fruits and vegetables that they had in front of them. Mr. Jones began the lesson by asking

1. _____ "Look at the vegetables. What do you notice about the watermelon, cucumber and yellow squash?"
2. _____ "The watermelon is big," said Harry.
3. _____ "The cucumber is long and thin," said Joe.
4. _____ "The yellow squash has seeds inside of it," said Bill.
5. _____ "So does the watermelon!" quipped Kerry.
6. _____ "And the cucumber too," blurted Benny.
7. _____ "Feel the insides. How do they feel?" said Mr. Jones.
8. _____ "They feel moist inside," stated Stanley.
9. _____ "Now feel their coverings," said Mr. Jones.
10. _____ "Why, they're all waxey!"
11. _____ "Why do you think the covering feels that way?" asked Mr. Jones.
12. _____ "To keep in the moisture," answered Amy.
13. _____ "What kind of coating do you think a Honey Dew melon would have?" asked Mr. Jones.
14. _____ "I think it would be somewhat waxey also," commented Cami.
15. _____ "How about this vegetable?" (Mr. Jones shows them a zuchinni squash.) "What will its insides look like?"
16. _____ "If the outside was waxey then it will be moist inside," explained Edgar.
17. _____ "Why do you say that?" asked Mr. Jones.
18. _____ "Because plants that have waxey coatings have high moisture content," pronounced Pamela.

APPENDIX 2

Directions: Read the following anecdotes and determine if they're inductive or deductive and explain why.

A. A fourth grade teacher was teaching her children how to divide words into syllables. She showed words with the syllables marked. The words were as follows:

wel' come
met' tle
squir' rel
spin' die

She then asked the students to observe the words and tell her what they observed about the syllabication. After ensuing discussion the students decided that all the words were divided between two consonants. She then showed the students additional examples of words and asked the students to divide them into syllables on what they decided.

B. A math teacher was drilling his third grade class on the "9s" multiplication tables. He put the following problems on the board:

9 x 3 =
4 x 9 =
7 x 9 =
2 x 9 =

After the students had answered the problems, one student raised her hand and said, "Hey, all individual digits in the products all add up to 9: Like 2 and 7 are 9 and 6 and 3 are 9. How did the student arrive at this conclusion?

Note that in these exercises students aren't asked to actually construct an inductive lesson but only identify one. If the students successfully accomplish this task, the next logical step would be to ask them to actually construct or plan an inductive lesson.